



# Cynllun Gweithredu Thematig Natura 2000 Newid Hinsawdd a Chwalu Cynefinoedd

## Natura 2000 Thematic Action Plan Climate Change and Habitat Fragmentation

Rhaglen Natura 2000 LIFE yng Nghymru  
LIFE Natura 2000 Programme for Wales



LIFE N2K Wales: LIFE NAT11/UK/385  
Supported by LIFE, a financial instrument of the European Community

Published by:  
Natural Resources Wales  
Cambria House  
29 Newport Road  
Cardiff  
CF24 0TP

0300 065 3000 (Mon-Fri, 8am - 6pm)

[enquiries@naturalresourceswales.gov.uk](mailto:enquiries@naturalresourceswales.gov.uk)  
[www.naturalresourceswales.gov.uk](http://www.naturalresourceswales.gov.uk)

© Natural Resources Wales

All rights reserved. This document may be reproduced with prior permission of  
Natural Resources Wales

## Contents

1. Cyflwyniad.....	4
2. Introduction .....	6
3. Background.....	8
4. Issues and risks .....	11
5. Policy and legislative context .....	15
6. Current mechanisms and planned actions on sites to 2020.....	17
7. Rationale for strategic actions.....	21
8. Development of strategic actions .....	22
9. Strategic actions for Natura 2000 in Wales: Climate Change and Habitat Fragmentation .....	23
Appendix A:.....	26
Appendix B:.....	28
Appendix C: .....	30
Appendix D: .....	32

## Acknowledgements

Many thanks to everyone within Natural Resources Wales and externally who contributed to the development of strategic actions for this Thematic Action Plan during the LIFE Natura 2000 Programme workshops or subsequent engagement period.

In particular thanks go to the following specialists who reviewed and refined the strategic actions: Clive Walmsley, James Latham.

December 2015

# 1. Cyflwyniad

## Rhaglen Natura 2000 LIFE yng Nghymru

Mae 92 Ardal Cadwraeth Arbennig (ACA) ac 20 Ardal Gwarchodaeth Arbennig (AGA) Cymru'n cynnwys 123 o nodweddion cynefinoedd a rhywogaethau dynodedig. Gyda'i gilydd, y rhain yw rhwydwaith Natura 2000.

Mae Rhaglen Natura 2000 LIFE yng Nghymru wedi datblygu blaen-gynllyn strategol i reoli ac adfer Natura 2000 yng Nghymru. Drwy weithio â rhanddeiliaid mae wedi pennu'r prif heriau sy'n wynebu'r safleoedd, y rhywogaethau a'r cynefinoedd hyn a warchodir gan Ewrop, a nodi'r camau gweithredu sydd eu hangen, y blaenoriaethau, y costau a'r cyfleoedd cyllido i fynd i'r afael â nhw.

Cafodd y rhaglen ei chynnal gan Cyfoeth Naturiol Cymru a'i hariannu gan gynllun LIFE+ Nature yr Undeb Ewropeaidd.

Y pwrpas yw galluogi Cymru i wneud cynnydd sylweddol tuag at sicrhau bod rhywogaethau a chynefinoedd Natura 2000 mewn cyflwr ffafriol a helpu i gyflawni ei hymrwymadau o dan Gyfarwydddeb Cynefinoedd ac Adar yr Undeb Ewropeaidd. Mae'r Rhaglen yn ceisio darparu llwyfan hefyd i sicrhau rhagor o gyllid ar gyfer prosiectau sy'n gysylltiedig â Natura 2000 o bob ffynhonnell bosibl, ac i integreiddio cyllid Natura 2000 mewn offerynnau ariannol a meysydd polisi eraill.

Mae manylion llawn Rhaglen Natura 2000 LIFE a rhwydwaith Natura 2000 yng Nghymru yn Ffeithiau a Ffigurau, Rhaglen Natura 2000 LIFE yng Nghymru: Adroddiad 1.

## Cynlluniau Gweithredu Thematig

Mae Rhaglen Natura 2000 LIFE wedi creu 11 Cynllun Gweithredu Thematig, pob un yn ymdrin â chamau gweithredu strategol blaenoriaeth i fynd i'r afael â'r prif broblemau a'r risgiau<sup>1</sup> a nodwyd fel y rhai sy'n cael effaith andwyol ar nodweddion Natura 2000 ledled y rhwydwaith.

Y Cynlluniau Gweithredu Thematig yw:

- Mynediad a hamdden
- Llygredd aer: Gwaddodi nitrogen
- Newid hinsawdd a chwalu cynefinoedd
- Llygredd dŵr gwasgaredig
- Rheoli perygl llifogydd ac erydu arfordirol
- Rheoli pori a da byw
- Rhywogaethau a phathogenau estron goresgynnol
- Newidiadau gan ddyn i amodau hydrolog
- Sbwriel y môr
- Pysgodfeydd morol
- Rheoli coetiroedd

---

<sup>1</sup> Problemau (neu bwysau) yw adweithiau andwyol i nodweddion Natura 2000 sy'n digwydd ar hyn o bryd ar neu yng nghyffiniau ACA neu AGA sy'n rhwystro'r rhywogaeth neu'r cynefin dynodedig rhag cyrraedd cyflwr ffafriol. Risgiau (neu fgythiadau) i nodweddion Natura 2000 sy'n debygol o ddigwydd erbyn 2020.

Y brif gynulleidfa ar gyfer y Cynlluniau Gweithredu yw rheolwr, pobl sy'n gwneud penderfyniadau a chyllidwyr yn Cyfoeth Naturiol Cymru, Llywodraeth Cymru a sefydliadau partner allweddol.

Mae'r camau gweithredu i'w gweld yn y tabl yn Adran 9. Camau yw'r rhain y gellir eu cyflawni ar lefel genedlaethol neu ranbarthol, i ategu camau gweithredu ar safleoedd o fewn Cynlluniau Gwella â Blaenoriaeth. Maent yn ceisio mynd i'r afael â rhwystrau sylfaenol, a'u hachosion lle bo'n bosibl, a datblygu fframwaith strwythurol sy'n cefnogi ac yn hyrwyddo trefniadau rheoli priodol yn lleol. Mae'r camau gweithredu'n cynnwys y rhai sydd eu hangen i fynd i'r afael â bylchau mewn tystiolaeth sy'n atal dealltwriaeth lawn o anghenion rheoli.

Gall rhai camau gweithredu strategol gynnig ffrydiau gwaith newydd a mentrau mawr; mae eraill yn cyd-fynd i raddau helaeth â pholisïau, strategaethau a rhaglenni gwaith sy'n bodoli eisoes neu sydd wrthi'n cael eu datblygu.

Cafodd y camau gweithredu strategol eu nodi yn ystod gweithdai a gynhaliwyd gyda gweithwyr proffesiynol arbenigol yn y maes, o Cyfoeth Naturiol Cymru a sefydliadau eraill. Roeddynt yn seiliedig hefyd ar grynodedau o gamau gweithredu ar safleoedd a oedd yn deillio o'r Cynlluniau Gwella â Blaenoriaeth a'r Gronfa Ddata Camau Gweithredu (gweler isod). Cafodd y rhain eu hadolygu a'u dilysu gan weithgor bychan a buont yn destun proses ymgysylltu a thrafod gyda rhanddeiliaid hefyd. Gweler Adran 8 am ragor o fanylion.

Y camau gweithredu strategol yw'r rhai a nodwyd sydd eu hangen i gael y nodweddion i gyflwr ffafriol. Maent yn amodol ar y graddau y mae adnoddau ar gael ac ar gytundeb rhanddeiliaid. Nid ydynt yn cynrychioli cynllun gweithredol sydd wedi'i ariannu'n llawn nac wedi ymrwymo'n llawn iddo. Fodd bynnag, y bwriad yw defnyddio'r camau gweithredu i lywio amrywiaeth o gynlluniau gweithredol a rhaglenni gwaith yn y dyfodol.

Er bod y camau gweithredu strategol yn canolbwyntio ar gyfres Natura 2000, gellir defnyddio llawer ohonynt yn eang a gallent fod o fudd i Safleoedd o Ddiddordeb Gwyddonol Arbennig a helpu i warchod bioamrywiaeth a chryfhau'r ecosystem yn yr amgylchedd ehangach.

### **Cynlluniau Gwella â Blaenoriaeth a Chronfa Ddata Camau Gweithredu**

Mae Rhaglen Natura 2000 LIFE wedi cynhyrchu Cynlluniau Gwella â Blaenoriaeth ar gyfer pob safle Natura 2000 yng Nghymru. Mae'r cynlluniau hyn yn nodi'r prif broblemau a risgiau sy'n effeithio ar nodweddion Natura 2000 ac yn disgrifio'r camau gweithredu â blaenoriaeth, wedi'u costio, sydd eu hangen i gael a chynnal nodweddion y safle mewn cyflwr ffafriol. Mae'r cynlluniau'n defnyddio gwybodaeth o Gronfa Ddata Camau Gweithredu Cyfoeth Naturiol Cymru sy'n cynnwys yr holl gamau gweithredu (blaenoriaeth uchel, canolig, isel) ar gyfer safleoedd Natura 2000. Datblygwyd y camau gweithredu gan Swyddogion Cadwraeth Cyfoeth Naturiol Cymru ar y cyd â rhanddeiliaid a phartneriaid. Cafodd cynnwys y Gronfa Ddata ei ymestyn a'i ddiweddarau'n llawn yn ystod 2014/5.

## 2. Introduction

### LIFE Natura 2000 Programme for Wales

There are 123 designated habitat and species features on the 92 Special Areas of Conservation (SACs) and 20 Special Protection Areas (SPAs) in Wales. Together these comprise the Natura 2000 network.

The LIFE Natura 2000 Programme for Wales has developed a strategic forward plan to manage and restore Natura 2000 in Wales. Working with stakeholders it has determined the key challenges facing these European protected sites, species and habitats and identified the actions required, priorities, costs and funding opportunities to address them. The Programme was run by Natural Resources Wales (NRW) and funded by the European Union scheme LIFE+ Nature.

The purpose is to enable Wales to make significant progress towards bringing Natura 2000 species and habitats into favourable condition and help meet its commitments under the European Habitats and Birds Directives. The Programme also aims to provide a platform to seek further funding for Natura 2000 related projects from all potential sources, and to integrate Natura 2000 funding into other financial instruments and policy areas.

Full details about the LIFE Natura 2000 Programme and the Natura 2000 network in Wales can be found in the *LIFE Natura 2000 Programme for Wales: Fact and Figures Report*.

### Thematic Action Plans

The LIFE Natura 2000 Programme has created 11 Thematic Action Plans, each of which detail priority strategic actions to address major issues and risks<sup>2</sup> which have been identified as having an adverse impact on Natura 2000 features across the network.

The Thematic Action Plans are as follows:

- Access and recreation
- Air pollution: Nitrogen deposition
- Climate change and habitat fragmentation
- Diffuse water pollution
- Flood and coastal erosion risk management
- Grazing and livestock management
- Non-native invasive species and pathogens
- Man-made changes to hydraulic conditions
- Marine litter
- Marine fisheries
- Woodland management

---

<sup>2</sup> Issues (or pressures) are adverse impacts to Natura 2000 features which are currently taking place on or around SACs or SPAs which act as barriers to the designated habitat or species features reaching favourable condition. Risks (or threats) are impacts to Natura 2000 features which are likely to occur by 2020.

The primary audience for the Actions Plans are managers, decision makers and fund holders within Natural Resources Wales, Welsh Government and key partner organisations.

The strategic actions are set out in the table in Section 9. These are actions which may be delivered at national or regional level, to complement the site-level actions within Prioritised Improvement Plans (PIPs). They seek to address fundamental barriers and where possible their root causes, and to develop a structural framework which supports and promotes appropriate management at a local level. Actions include those needed to address evidence gaps which are hindering full understanding of management needs. Some strategic actions may propose new work streams and larger-scale initiatives; others align closely to existing or developing policies, strategies and work programmes.

The strategic actions were identified during workshops held with professionals with expertise in the field, from Natural Resources Wales and other organisations. These were also informed by summaries of site level actions derived from the PIPs and Actions Database (see below). These were reviewed and validated by a small working group and also subject to a process of engagement and discussion with stakeholders. See Section 8 for more details.

The strategic actions are those which have been identified as being required to bring features into favourable condition. They are subject to resource availability and stakeholder agreement. They do not represent a fully funded or committed operational plan. However, the intention is that the actions will be used to inform a range of operational plans and work programmes in the future.

While the strategic actions are focused on the Natura 2000 series, many have a broad applicability and will also be of benefit to Sites of Special Scientific Interest and other biodiversity conservation and ecosystem resilience work in the wider environment.

### **Prioritised Improvement Plans and Actions Database**

The LIFE Natura 2000 Programme has produced Prioritised Improvement Plans (PIPs) for all Natura 2000 sites in Wales. The PIPs identify the main issues and risks affecting the Natura 2000 features on the site and describe costed, prioritised actions required to achieve and maintain the site features in favourable condition.

The PIPs draw information from the Natural Resources Wales Actions Database which hold all actions (high, medium, low priority) for Natura 2000 sites. Actions were developed by Natural Resources Wales Conservation Officers in association with stakeholders and partners. The content of the Database was fully extended and updated during 2014/5.

### 3. Background

Work carried out by the LIFE Natura 2000 Programme for Wales in 2014/15 has identified both climate change and habitat fragmentation as priority issues/risks affecting Natura 2000 features in Wales<sup>3</sup>. This is consistent with the most recent round of UK level biodiversity reporting; the tenth UK 'Article 12 report'<sup>4</sup> and the third 'Article 17 report'<sup>5</sup> show that the effects of climate change and habitat fragmentation or lack of connectivity within the wider countryside is having (or has the potential to have) adverse impacts on the condition of SAC and SPA features in across the UK.

#### Climate Change

Climate change has been identified as a serious threat to UK biodiversity, with its effects already becoming apparent and expected to intensify in future as the magnitude of climatic changes increase<sup>6</sup>. Moreover, in the context of the Natura 2000 network climate change has been widely identified as a current and future threat to the network<sup>7</sup>.

In 2013 a strategic assessment entitled Climate Vulnerability Assessment of Designated Sites in Wales<sup>8</sup> was published. The work involved a Wales-specific climate impact-risk assessment for all individual habitats and species identified as site features, present on Welsh protected sites. This identified anthropogenic climate change caused by the emission of greenhouse gases as a priority issue for a large number of Natura 2000 features in Wales.

The Climate Vulnerability Assessment also developed the concept of a Climate Vulnerability Index (CVI), which was calculated for each site. This included ranking both features and sites according to their vulnerability. The CVI was based on information from the NRW Sites Database and GIS information on the features on protected sites, along with condition assessments and current management issues where these were available. A habitat fragmentation analysis was also undertaken for each protected site in relation to the surrounding landscape. These various components of vulnerability were then brought together in a single metric. The work was extended to cover marine Natura 2000 features in 2015<sup>9</sup>. Outputs of the climate change vulnerability assessments have been fed into the prioritisation of the actions carried out by the LIFE Natura 2000 Programme for Wales.

---

<sup>3</sup> Natural Resources Wales, 2015. *LIFE Natura 2000 Programme for Wales Summary Report*.

<sup>4</sup> Joint Nature Conservation Committee 2013 *10th Report by the United Kingdom under Article 12 on the implementation of the Directive on the conservation of wild birds (2009/147/EC) from January 2008 to December 2012*. JNCC, Peterborough.

<sup>5</sup> Joint Nature Conservation Committee 2013 *Summary of conclusions & qualifiers – 3rd UK Habitats Directive Reporting*.

<sup>6</sup> <http://www.nerc.ac.uk/research/partnerships/lwec/products/report-cards/biodiversity/report-card/>

<sup>7</sup> Bundesamt für Naturschutz (2012). *Natura 2000 and Climate Change – a Challenge*. Eds. Ellwanger, G., Ssymank, A. & Paulsch, C. Naturschutz und Biologische Vielfalt, 118. Bundesamt für Naturschutz, Bonn.

<sup>8</sup> Lucy Wilson, Rob McCall, Shaun Astbury, Anne Bhogal and Clive Walmsley (2013). *Climate Vulnerability Assessment of Designated Sites in Wales*. CCW Contract Science Report No. 1017.

<sup>9</sup> LIFE Natura 2000 Programme for Wales/NRW, 2015. *Climate Change Vulnerability of Marine Natura 2000 Features*.



Climate change is manifested in a range of potential environmental changes, for example:

- warmer average temperatures with generally milder winters and hotter summers associated with a greater risk of heatwaves;
- greater variability in rainfall, with generally drier summers and wetter winters, along with a greater proportion of intense rainfall events;
- accelerated rate of sea level rise around the coast leading to increased coastal erosion and inundation of freshwater habitats by saline water; and
- increased risk of inland flooding as well as potentially summer drought.

The impacts of these changes can cause damage to the extent and condition of designated habitats, supporting habitats for designated species or the species themselves. One of the main impacts of climate change is the shift in the distribution of species to higher latitudes and altitude as populations attempt to track suitable climatic conditions. While these changes can extend the range or increase the abundance of some species within Wales and the UK, these impacts may often be offset by losses elsewhere within the range. Projections show that there is a likelihood that some species will decline, and potentially be lost where they are unable to move to alternative locations due to their limited dispersal capacity or lack of suitable habitat e.g. montane species.

Good habitat connectivity in the wider landscape has an important role to play in maximising the chances of dispersal and improving the resilience of populations to climatic warming.

The evidence of changes in utilisation of Natura 2000 sites by migratory birds and other species and the potential for significantly greater changes in range in the future have raised questions about the value of protected areas under a changing climate. However, recent research has shown that for a wide range of taxa, protected areas facilitate range expansions with incoming species preferentially occupying them such that their value for biodiversity conservation will remain even if some features move elsewhere.<sup>10</sup> Range extension may equally occur among non-native invasive species, disease and pathogens which may lead to an increased impact.

The impacts of changes in phenology (that is changes in the timing of natural events such as flowering, leaf emergence etc.) will vary between species, from beneficial to damaging, for example earlier springs could lead to earlier emergence from extended breeding periods or a disconnection in the synchronicity of ecological events e.g. the nesting period of a bird may no longer coincide with the peak emergence of prey invertebrates.

A range of studies have shown that changes in rainfall and temperatures, and particularly prolonged periods of drought will make wetland, river and lake features particularly vulnerable to climate change impacts. Storms and floods can produce physical damage and affect breeding success or ability to feed e.g. sea birds.

Sea level rise and associated coastal erosion and flooding, can exacerbate existing issues of coastal squeeze leading to loss of intertidal habitat. Cliff habitats can be lost to

---

<sup>10</sup> Thomas, C.D., *et al*, 2012. *Protected areas facilitate species' range expansions*. Proceedings of the National Academy of Sciences, **109**, 14063-14068.

erosion and low lying freshwater features suffer gradual or catastrophic saltwater inundation. Such issues relating to coastal management and measures to address them are covered in more detail in the LIFE Natura 2000 Programme *Coastal Erosion and Risk Management Thematic Action Plan*.

It is acknowledged that major national or international action to reduce anthropogenic greenhouse gas emissions and create/enhance the biological sinks for greenhouse gasses such as woodlands and peatland is essential to reducing the impacts of climate change on the Natura 2000 sites. Nevertheless, the impacts of climate change which are already being experienced on sites are very likely to continue for many decades to come and so adaptation actions to reduce adverse impacts are also essential.

It is vital that any climate change adaptation measures are integrated within general work programmes for each site. Key stakeholders in implementing this adaptive approach would include the Welsh Government, conservation NGOs, land owners, NRW, and on cross-border sites, Natural England.

### **Habitat fragmentation**

One of the major issues affecting ecosystem functioning and biodiversity conservation results from the loss and fragmentation of natural habitats. This has taken place for hundreds of years as natural habitats have been cultivated and modified, or replaced by artificial systems and the built environment. Nature conservation legislation and greater public awareness have reduced the rates of decline, but losses still continue, especially the loss of smaller patches of habitat which provide the connectivity within our landscape. These changes and the resulting fragmentation have profound impacts on biodiversity and ecosystems in general with the resulting effect being the reduction of the fitness or resilience of the organisms and populations which make up our habitats and species. This makes them more vulnerable. Climate change is an over-riding factor, interacting with all of the above and produces an additional stress.<sup>11</sup>

There is increased recognition of the impact that landscape configuration and composition has on ecosystem services. The impact that habitat fragmentation has on the provision of ecosystem services is complex. Connectivity has the potential to play a key role in the provision of ecosystem services because many of these services depend on the promotion or restriction of the movement of organisms and materials within landscapes. Improvements in the connectivity of a landscape which is important for the conservation of protected species can therefore help to develop 'win win' solutions that contribute to biodiversity conservation while supporting socio-economic development.

---

<sup>11</sup> Hopkins, J. (2013) Nature conservation in the early 21st century: all change? *British Wildlife*, 24(3),183-189.

## 4. Issues and risks

### Climate Change

The LIFE Natura 2000 Programme data shows that issues exacerbated by climate change are having (or likely to have) an adverse impact on 81 out of 123 different Natura 2000 habitat or species features (66%), on 77 out of 112 Natura 2000 sites across Wales (69%). Table 2 provides a list of features most frequently affected.

As an issue or risk in its own right 'climate change' is logged a total of only 19 times (i.e. four times at a unit level and 15 times at a site level). However, in many cases, climate change impacts are expressed by the exacerbation of other issues and risks, such as increased risk of fire, higher levels of coastal squeeze, or greater prevalence of invasive species, pathogens and disease. In such cases, NRW Conservation Officers tend to log the specific issue or risk rather than the more generic 'climate change' driver of that change. Without significant additional analysis it is therefore impossible to fully assess the extent of the climate change issues and risks across the network.

The climate change vulnerability assessment of protected areas in Wales<sup>12</sup> included an assessment of those issues and risks with a high likelihood of being exacerbated by climate change impacts. These issues and risks are shown in Table 1 below, along with the number of instances where the issue/risk was logged against a Natura 2000 feature on a site.

**Table 1. Issue and risks (sub-categories) with high risk of exacerbation by climate change**

Issue and risks (sub-categories) with a high risk of exacerbation by climate change	Instances of issue/risk on Natura 2000 sites
Drainage	106
Fire - deliberate or accidental	63
Water levels (including barriers to natural hydrology and altered water flow)	52
Water abstraction	23
Diseases pathogens and parasites	20
Coastal flood defence and erosion control (squeeze)	18
Tree planting, past and present	16
Natural coastal processes and sediment supply	13
Inland flood defence and erosion control	9
Energy production - renewables: hydro-electric	7
Water quality - sediment pollution	7
Water quality - turbidity	1

<sup>12</sup> Lucy Wilson, Rob McCall, Shaun Astbury, Anne Bhogal and Clive Walmsley (2013). *Climate Vulnerability Assessment of Designated Sites in Wales*. CCW Contract Science Report No. 1017.

## Features affected

The research assessment of the vulnerability to climate change of protected areas included a qualitative assessment of the relative vulnerability of all the terrestrial Natura 2000 habitat and species features. This was expanded in 2015 to include marine features by the LIFE Natura 2000 Programme.

Of the features to be found on Natura 200 sites 50 features are listed as having a high level of vulnerability to climate change. The full list is shown in Appendix A. The main groups of features are shown below.

**Table 2. Types of Natura 2000 features which are highly vulnerable to climate change impacts**

<b>Natura 2000 features highly vulnerable to climate change impacts</b>
Raised bogs and blanket bogs
Calcium-rich fens
Various lake features
Shifting dunes and dune grassland
Woodlands such as Western acid oak woodland and Bog woodland
Salt meadows
Calaminarian grassland
Base-rich scree
Coastal lagoons
Intertidal mudflats and sandflats
Depressions on peat substrate
Grey seal and Bottle-nosed dolphin
Dune species – Fen orchid and Petalwort
Freshwater-pearl mussel
Whorl snails
Waterfowl, such as Pintail, Teal and Gadwall
Waders such as Dunlin, Knot, and Oystercatcher
Sea birds such as Red-throated diver, Common scoter, and Common tern
Merlin
Chough

## Highest priority features for action to address climate change

An analysis of the actions relating to Natura 2000 sites held in the NRW Actions Database has identified those features which have both a high vulnerability and also have one or more issues or risks that are likely to be exacerbated by climate change. Those features with more than 10 issues/risks currently logged against them are set out in Table 3.

**Table 3. List of features that can be currently regarded as the highest priority for action to address climate change related issues/risks**

Natura 2000 feature (common name)	No of issues/risks affecting feature
Blanket bog	84
Purple moor-grass meadows	41
Degraded raised bogs	34
Calcium-rich springwater-fed fens	31
Calcium-rich fen dominated by great fen sedge (saw sedge)	22
Petalwort	22
Active raised bogs	21
Western acidic oak woodland	20
Chough	16
Fen orchid	15
Mixed woodland on base-rich soils associated with rocky slopes	15
Calcium-rich nutrient-poor lakes, lochs and pools	14
Intertidal mudflats and sandflats	12
Atlantic salt meadows	11

## Habitat Fragmentation

The LIFE Natura 2000 Programme data shows that habitat fragmentation is having (or likely to have) an adverse impact on 48 out of 123 different Natura 2000 habitat or species features (39%), on 36 out of 112 Natura 2000 sites across Wales (32%). Table 4 below provides a list of features most frequently affected. The range of features affected includes, but is not restricted to, species such as amphibians, invertebrates, mammals and plants, and habitats such as forests, coastal sand dunes, bogs and fens or temperate heath. For a full list of sites and features affected see Appendices C and D respectively.

A total of 143 instances of issues and risks related to habitat fragmentation were recorded across the Natura 2000 series (on individual units or on whole sites), out of a total of 3,090 records (for all types of issue and risk) (5%).

**Table 4. Natura 2000 features most frequently adversely affected by habitat fragmentation**

Feature (common name)	Number of instances feature affected		
	Unit level	Site level	Total
Great crested newt	51	3	54
Calcium-rich springwater-fed fens	33	0	33
Marsh fritillary butterfly	22	8	30
Calcium-rich fen dominated by great fen sedge (saw sedge)	21	0	21
Degraded raised bogs	11	0	11
Western acidic oak woodland	3	3	6
Geyer`s whorl snail	5	0	5
Purple moor-grass meadows	4	1	5
Fen orchid	2	3	5
Lesser horseshoe bat	0	5	5

### Examples of habitat fragmentation on Natura 2000

On SACs such as Corsydd Mon, Blaen Cynon, Caeau Mynydd Mawr and Glaswelltiroedd Cefn Cribwr the fragmentation of the habitat used by Marsh fritillary butterfly requires habitat restoration or creation for the continued survival of this fragile species, linking population not only within the site but also in the surrounding landscape. This is also required at Glantraeth, Deeside and Buckley Newt Sites and Johnstown Newt Sites for the benefit of Great crested newts.

In order to address habitat fragmentation of the Western acidic oak woodland at Coedydd Derw a Safleoedd Ystumod Meirion it is necessary to look outside the existing Natura 2000 boundary in order to restore the connectivity between the fragmented woodland compartments of this SAC and improve the resilience of the feature.

On dynamic habitats such as those found on the sand dunes of Carmarthen Bay Dunes, Y Twyni o Abermenai i Aberffraw, and Morfa Harlech a Morfa Dyffryn the mobile nature of sand dune features requires detailed vegetation information in order to inform management and ensure the connectivity and functionality between the interlinked features are maintained.

Wetland features are also affected by habitat fragmentation, one of the main issues relates to areas important to the hydrological functionality of sites being located outside the boundary of some Natura 2000 sites. Often bringing them under appropriate management is essential to achieving favourable condition but their exclusion from the sites makes this difficult in practice.

## 5. Policy and legislative context

There is a broad framework of policy and legislation at the international, UK and Welsh level which drives and supports the management of Natura 2000. The primary European legislation is the Habitats Directive and the Birds Directive which promote the conservation and management of natural habitats and wild species. Key UK legislation includes the Habitats Regulations, Wildlife and Countryside Act, and the Countryside and Rights of Way Act. Wales is developing a new approach to integrated and sustainable natural resource management, through for example, the Environment (Wales) Bill and the Nature Recovery Plan. Further information is provided in the *LIFE Natura 2000 Programme Facts and Figures Report*.

Policy and legislation which specifically relates to the issue of climate change and habitat fragmentation are as follows:-

- **Climate Change Act 2008** – provides at UK level, governance arrangements for setting UK carbon budgets, undertaking the UK Climate Change Risk Assessment and providing powers for Welsh Government to address climate risk and mainstream consideration of adaptation.
- **Welsh Government Climate Change Strategy for Wales 2010** – this strategy sets out the case for tackling climate change in terms of both mitigation and adaptation in a Welsh context. It includes a Mitigation Delivery Plan and Adaptation Delivery Plan that set out the actions for each sector, including the need to monitor impacts on the natural environment, expand woodland cover, restore peatland, etc. Some of the actions have been superseded or amended after a review in 2014/15.
- **Natural Environment Sectoral Adaptation Plan: Welsh Government (estimated publication March 2016)** – this plan sets out the risks to the natural environment in Wales, including the nature conservation, agricultural and forestry sectors. It also summarises the range of actions that are underway to mainstream consideration of climate change in the marine, freshwater and terrestrial environments and the agricultural and forestry sectors.
- **Shoreline Management Plans (adopted 2015) (SMPs)** – there are four non-statutory SMPs in Wales that provide a large scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. They include consideration of the effects of sea-level rise and the effects of climate change.
- **Water Framework Directive River Basin Management Plans (RBMP)** – RBMPs aim to protect and improve the water environment for the benefit of people and wildlife. The plans set out how organisations, stakeholders and communities will work together to achieve an improved water environment for each River Basin District. RBMPs have particular relevance to climate change and habitat

fragmentation with regard to coastal waters, flood management and mitigation and reconnecting flood plains.

- **Welsh Government Water Strategy 2015** – this strategy sets out our strategic direction for water policy over the next 20 years and beyond, including the consideration of the projected changes in rainfall and water quality and availability due to climate change.
- **Welsh National Marine Plan (in preparation)** – this Plan is being developed to manage marine activities in a sustainable way, taking into account; economic, social and environmental priorities. It includes consideration of climate change impacts and the important role that the marine environment can play in mitigation and the need for adaptation including enhancing ecosystem resilience for marine biodiversity.
- **Environment (Wales) Bill** – The Bill and supporting Natural Resources Policy Statement (NRPS) will set out a framework for building resilience. This will be central to Sustainable Management of Natural Resources which NRW will have a duty to pursue in the exercise of its functions. Connectivity is recognised as key element for building resilience, and this will need to be achieved through a range of actions that offset fragmentation. The Bill also sets out a governance framework for setting greenhouse gas emission targets and 5-yearly carbon budgets for Wales.
- **Well-Being of Future Generations (Wales) Act 2015 (WoFGA)** - The Act aims to improve the social, economic, environmental and cultural well-being of Wales, and includes goals to both reduce emissions through developing a low carbon economy and improve the resilience of Wales based on a biodiverse environment with functioning ecosystems; the capacity to adapt to climate change is recognised as a key part of this. Connectivity is fundamental to building resilience and to allow this adaptation, and the Act brings a responsibility for public bodies to improve it, which will often be achieved through decreasing fragmentation.
- **Nature Recovery Plan 2016** - Welsh Government's strategic plan for implementing some of the aims set out in the Environment (Wales) Act and WoFGA through Sustainable Management of Natural Resources. It contains a series of objectives which include reference to building resilience, improving connectivity and decreasing fragmentation through maintaining, enhancing, restoring and creating habitat.



## 6. Current mechanisms and planned actions on sites to 2020

The LIFE Natura 2000 Programme identified and costed actions to address issues relating to climate change and habitat fragmentation on Natura 2000 sites during 2014/15 for the period to 2020. These actions are held in full in the NRW Actions Database and summarised in Prioritised Improvement Plans (PIPs).

Actions expressed in terms of the delivery mechanism are shown below in Table 5 and 6. This includes high, medium and low priority actions. These actions include those which are planned or already underway. It shows the number of times mechanisms are listed against an action on a Natura 2000 site or management unit within a site and also specifies estimated costs and staff time.

The mechanisms and costs shown in Table 5 only relate to actions where climate change itself has been recorded as an issue/risk on a site. As explained many actions to ameliorate climate change are in fact incorporated into routine management actions. These are too numerous to be itemised here, and it is not possible to identify which element of the cost relates specifically to additional needs due to climate change. The mechanisms shown below provide examples of those which are commonly employed, but the costs should not be regarded as a comprehensive total.

**Table 5. Key mechanisms identified in the LIFE Natura 2000 Programme data to address issues/risks associated with climate change on Natura 2000 sites in Wales**

Mechanism	No of instances of mechanism	Total cost (£)*	Total NRW staff days*
Investigation	8	£20,000	20
Risk surveillance	7	£7,500	56
Direct management	4	n/a	1
Targeted education, awareness raising & liaison	2	n/a	30
Changes to policy and/or legislation	1	£0	10
Management agreement (Glastir)	1	£117,000	25
Management agreement (NRW)	1	£123,000	25
Notification amendment	1	£0	n/a

**Table 6. Key mechanisms identified in the LIFE Natura 2000 Programme data to address issues/risks associated with habitat fragmentation on Natura 2000 sites in Wales**

Mechanism	No of instances of mechanism	Total cost (£)*	Total NRW staff days*
Management agreement (NRW)	55	£647,000	238
Investigation	45	£343,000	309
Direct management	42	£441,000	479
Notification amendment	18	£18,000	454
Targeted land and /or rights purchase	15	£1,239,000	150
Targeted education, awareness raising & liaison	5	£0	30

*\*The costs are broad estimated costs to deliver the action(s), rounded to the nearest thousand. In most cases the costs are calculated to 2020 except where longer term funding would be needed. The number of NRW staff days is the number of annual staff days x 5 (for number of years until 2020) which would be needed, plus the number of one-off staff days until 2020. Note that there are a number of uncosted actions, due to the difficulty of estimating costs where more in-depth action specific information is required.*

*The number of instances of a mechanism is influenced by the number of land holdings across the site or unit where it is required. The majority of Natura 2000 sites have numerous land owners and some units also have more than one land owner (i.e. some of the river units are several kilometres long).*

The most frequently used mechanisms described below:

- **Direct management** – the direct implementation of agreed work programmes.
- **Risk surveillance** – where the feature needs to be monitored to ensure the risk does not become an issue.
- **NRW Management Agreements** – a framework for payment for specific environmental management.
- **Glastir, the Welsh agri-environment scheme** - the scheme includes targets for climate change mitigation, such as carbon sequestration. Prescriptions also promote adaptation through general landscape improvements and increased connectivity, for example by woodland creation.
- **Investigation** – where a cause of unfavourable condition needs to be identified or further information is required before a relevant party or action can be identified.
- **Notification amendments** – when areas of land outside the existing site boundary have the features of interest or require inclusion to instigate appropriate management of the feature a notification amendment may be required to include the area within the site.

- **Targeted land and/or rights purchase** - to secure appropriate management/ restoration of the land when a management agreement or other means cannot deliver.

### **Routine conservation management action**

Much of the valuable work relating to the management of climate change is delivered through traditional forms of protected site management, which seeks to reduce risk and develop a resilient, robust and heterogeneous habitats on the site. For example, climate change may increase the risk of disease in woodlands, but this may be managed by developing a more resilient species rich, multi-age woodland. Likewise, climate change may exacerbate the risk of fire on heathlands but this may be best managed by establishing an appropriate grazing regime and introducing good fire management practice.

A number of other mechanisms, tools and projects are in place to manage the impacts of climate change and habitat fragmentation on the environment and Natura 2000 sites in Wales. Examples include:

### **Panels and committees**

- **UK Committee on Climate Change** – responsible for proposing and advising on UK and Welsh carbon budgets and GHG targets along with production of UK Climate Change Risk Assessment of impacts, risks and vulnerability.
- **Climate Change Commission for Wales, including Adaptation Sub-group** – the Commission is an independent body providing leadership on climate change and help facilitate efforts by Welsh Government and a wide range of stakeholders to tackle climate change by providing advice, as well as scrutinising and reporting on progress, including for the natural environment sector.
- **Natural Environment Sectoral Adaptation Plan Working Group** – responsible for developing the adaptation action plan for terrestrial, freshwater and marine ecosystems, including actions for the nature conservation sector.
- **Nature Recovery Plan Working Groups.**
- **Natural Resource Management Practitioners' Group.**

### **Projects directly related to climate change**

- **NRW/CCW Climate Change Adaptation Plans** – Plans for Natura 2000 sites at imminent risk. A small number of plans have been prepared for example, Pembrokeshire Bat Sites and Bosherton Lakes SAC and Cors Fochno SAC.
- **National Habitat Creation Programme** - A major project led by NRW, which is delivering adaptation in terms of coastal defence management and compensatory coastal habitat for impacts of coastal defence measures on Natura 2000 sites.
- **Keeping Rivers Cool Project** - A project led by NRW and the Environment Agency in England, which promotes the development of shade as a key adaptation mechanism for small rivers.

- **Plimlimon Project** - A pioneering, science-based project to revive the ecology and economy of the Welsh uplands which also included carbon safeguarding and carbon storage.
- **Landscape scale projects** - such as the Wildlife Trusts Living Landscapes, and Keep Wales Tidy Long Forest

#### **Grant schemes with key climate change elements**

- **Rural Development Plan** - There is a requirement for 20–30% of the total budget to deliver climate change adaptation and mitigation.

## 7. Rationale for strategic actions

The majority of the current mechanisms used to address issues and risks on Natura 2000 sites tend to focus on localised actions. While they can produce good results at a local level they are limited in their ability to deliver the appropriate management required on a Wales or area-basis.

Given the financial constraints, it is important that a consistent approach to assessing the impact that climate change is having on Natura 2000 sites is adopted and that resources are focused on the sites where the need is most pressing so that there is a strategic approach to implementing suitable adaptation actions. The climate change vulnerability index for the Natura 2000 sites (described earlier) provides a key tool to inform such prioritisation.

In order to address habitat fragmentation of Natura 2000 habitat and species we need to understand their ecological connectivity with the landscape. Previous work started by the Countryside Council for Wales on habitat network modelling started the process of mapping connectivity of some habitat types in Wales. Since our Natura 2000 sites are focal points for some habitat and species in the landscape by completing the network maps they can be used to help understand the significance of habitat patches in the landscape and the functional relationships between them. These maps could provide a general guide to the location of habitat restoration and expansion required in order to build resilience into the features of our Natura 2000 network.

To address these points a set of strategic actions have been identified to address impacts from climate change and habitat fragmentation on Natura 2000 features as shown in the tables in Section 9.

## 8. Development of strategic actions

The strategic actions were developed through a process of consultation in combination with analysis of the LIFE Natura 2000 Programme data. Summary outputs of the data from Natura 2000 sites was used to provide contextual background for a Climate Change Thematic workshop held in Shrewsbury on 29 June 2015.

Attendees were specialists from Natural Resources Wales and other bodies with an expertise in climate change. Participants were asked to consider existing management methods for issues arising from climate change and to identify new strategic actions which could address impacts regionally or at a Welsh or UK level. These actions were then reviewed by a small working group.

The Habitat fragmentation actions were derived by analysing the output from all the thematic plan workshops and reviewed and enhanced with NRW specialists.

The draft strategic actions were made available for comment to a wider audience through a series of three workshops during the summer of 2015. The first workshop on the 29 June 2015 was open to sector leads from Welsh Government, while the second and third workshops (held on the 19 and 25 August 2015, in Garwnant and Bangor respectively) and were attended by representatives of interested organisations in Wales, from, for example, the third sector, local authorities, farming unions and other user groups. There was a total of 84 attendees. The consultation drafts were also available to other organisations on request. The feedback received was reviewed and included in the actions as appropriate.

The strategic actions are intended to be SMART (Specific, Measurable, Assignable, Realistic and Time-related). Information has been provided on costs and time-scales where possible. A proposed lead delivery organisation is listed against each action. The intention is that this organisation will drive the action forward, collaborating with other partners and stakeholders as necessary. It is anticipated that the strategic actions will be used to guide future work programmes.

## 9. Strategic actions for Natura 2000 in Wales: Climate Change and Habitat Fragmentation

The following represent a list of proposed actions needed to make progress towards favourable condition of Natura 2000 (N2K) features. They do not represent a fully funded or committed operational plan.

### Strategic Actions – Climate Change

	Action	Detail	Priority	Link to existing work programmes	Proposed lead organisation	Proposed partner organisation(s)	Estimated cost (£)	Proposed timetable
1	Ensure that needs relating to N2K sites and climate change are fully integrated within the implementation of the Wales Future Generations Act; Environment (Wales) Bill; WG Natural Environment Sectoral Adaptation Plan and Nature Recovery Plan as part of ecosystem resilience.	Of particular relevance: <ul style="list-style-type: none"> <li>WFG duty on public bodies to “Maintain and enhance a biodiverse natural environment”</li> <li>Part 2 on climate change in the Environment Bill relating to mitigation</li> <li>Part 1 for Area-based Statements and need to embed adaptation</li> <li>WG Natural Environment Sectoral Adaptation Plan</li> <li>Nature Recovery Plan and connectivity</li> </ul>	High	Public Service Boards/Local Well-being Plans	Welsh Government	Natural Resources Wales	Staff time only	2015 - ongoing
2	Develop a programme of terrestrial and coastal habitat creation/restoration outside N2K site boundaries to enlarge sites (buffer zones) and promote connectivity (corridors and stepping stones) to improve resilience and allow dispersal of features in response to climate change on vulnerable sites.	To be carried out within the context of the NRM Area based approach and continued delivery of the National Habitat Creation Programme and Nature Recovery Plan. To be developed on a regional basis, considering specific needs of vulnerable sites.	High	Shoreline Management Plan Habitat Regulations Assessment National Habitat Creation Programme NRW Connectivity Mapping	Natural Resources Wales	Local Planning Authorities National Park Authorities Third sector organisations Farming unions	TBC	2017 - ongoing
3	Produce Welsh strategic climate change approach and guidance for managing highly vulnerable N2K species, habitats and sites.	To include ‘in principle’ approach to managing: <ul style="list-style-type: none"> <li>Features unable to disperse and therefore, at risk of loss in Wales, e.g. arctic alpiners, montane habitats, etc.</li> <li>Competing interests of freshwater features and marine features on coastal sites affected by sea level rise and increased storminess.</li> </ul>	High	Update of Conserving biodiversity in a changing climate (2007) UK Biodiversity Partnership guidance.	Natural Resources Wales	National Park Authorities Third sector organisations Wales Environment Link	Staff time only	2016-17
4	Prepare Climate Change Adaptation Plans for highly vulnerable N2K sites which are being or likely to be heavily impacted by climate change/sea-level rise/extreme weather events.  Deliver at least one pilot implementation project.	Follow an approach similar to plan created for Pembrokeshire Bat Sites and Bosherton Lakes SAC. Plans should consider: approach, competing needs of features, compensatory habitats, sea defences, management measures etc. and new mechanisms for addressing these issues.	Medium	Natural England Climate Change Adaptation Manual	Natural Resources Wales	Organisations with ownership or management responsibilities on identified sites.	TBC	2016-20

5	Develop guidelines to take advantage of and promote heterogeneity, aspect and micro-climate in site management to maximise resilience to climate change.	To include the commissioning of research and trialling to develop practical measures in key habitats.	Medium		Natural Resources Wales		Staff time, plus research contract	2015-17
6	Ensure that climate change implications for marine N2K sites are considered in the Marine Plan, including investigating impact of changing fisheries practice due to climate change.	Requires both embedding in marine policy and planning as well as research to develop management tools that help deliver improved resilience to climate change	Low		Welsh Government	Natural Resources Wales	Staff time, plus research contract	2015-ongoing
7	Deliver a programme of training to conservation practitioners on the principles and practice of managing N2K sites to manage for climate change impacts.	Particularly for NRW Conservation Officers and other Operational staff with N2K responsibilities.  To include information on resilience and healthily functioning, heterogeneous ecosystems.	Low		Natural Resources Wales	Wales Biodiversity Partnership  Wales Environment Link	Staff time only	2018-20
8	Liaise with key organisations to learn lessons and explore the future direction of N2K with regard to boundaries and feature designation in an era of climate change, and scope a new approach e.g. flexibility regarding boundaries (e.g. at low water) or features.	For example: <ul style="list-style-type: none"> <li>Flexibility of boundaries e.g. at low water.</li> <li>Flexibility of features.</li> <li>Designation of resilient e.g. heterogeneous sites.</li> <li>Increased use of buffers.</li> </ul> Should include development of generic EU-level climate change thematic plan addressing these issues.	Low		Natural Resources Wales	Welsh Government, other Member States, DG Environment and European Nature Conservation Agencies Climate Change Interest Group	Staff time only	2015-ongoing
9	Ensure N2K needs in relation to climate change are incorporated into monitoring and surveillance programmes.	Should include remote sensing to monitor saltmarsh extent as key climate change indicator of sea-level rise	Low		Natural Resources Wales		TBC	2015-ongoing



## Strategic Actions – Habitat Fragmentation

The following represent a list of proposed actions needed to make progress towards favourable condition of Natura 2000 (N2K) features. They do not represent a fully funded or committed operational plan. This plan refers to the issues /risks associated with habitat fragmentation and loss of connectivity as it applies to N2K habitats and species.

	Action	Detail	Priority	Link to existing work programmes	Proposed lead organisation	Proposed partner organisation(s)	Estimated cost (£)	Proposed timetable
1	Complete habitat and species network/connectivity mapping for all/groups of N2K habitats and species.	Ensure all N2K habitats and species features are network mapped as sole features or groupings to form a guide to overall connectivity and inform strategic biodiversity action.	High	Gap analysis NRW Connectivity Mapping	Natural Resources Wales	Local Planning Authorities Local Record Centres	Staff time & possible contract costs TBC	2015 - ongoing
2	Ensure incorporation of habitat and species network/connectivity maps (see action 1) into current policy and programme framework focusing around N2K network.	Promote the integration of ecological connectivity into decision-making processes with N2K network as a priority.	High	Local Development Plans Economic development policies Rural Development Plans National infrastructure planning / transport plans Shoreline Management Plans Natural resources planning and management Ecosystem services mapping Rights of Way Improvement Plans and other access plans Agri-environment targeting Green infrastructure plans National Park and AONB Management Plans Site notification programme Biodiversity offsetting and habitat banking Nature Recovery Plan Landscape-scale restoration projects Well-being Plan (WofFG Act) River Basin Management Plans	Natural Resources Wales Welsh Government	Local Authorities LBAPs Marine Management Organisation	Staff time TBC	2015 - ongoing
3	Target creation and restoration of woodland outside N2K site boundaries to improve resilience of N2K features.	Targeting woodland expansion to benefit ecosystem resilience of existing SAC features e.g. woodland habitats, bats.  Also expand woodland to address issues affecting other N2K sites, e.g. riverine or wetland sites.  Issues include climate change, air pollution, diffuse pollution, access and recreation, and flood and coastal erosion. Positive impacts of woodland creation may include increasing shade to riverine SACs, or filtering air or water borne pollutants.  Ensure new planting does not adversely impact other habitats and species.	High	Rural Development Plan funding Glastir woodland creation Potential for funding from joint working partnerships NRW management agreements Woodland Carbon Code Environment and Sustainable Development grant funding Compensatory (mitigating loss) planting from development Sustainable management of natural resources Natural resources policy Area based statements Nature Recovery Plan Carbon Net Positive Project	Natural Resources Wales Welsh Government	Forest and third sector woodland organisations Landowners and managers National Park Authorities Local Authorities	Staff time and could be project costs TBC	2015 - ongoing

**Appendix A: Natura 2000 features with high vulnerability to climate change (based on Wilson et al. 2013)**

Scientific name	Common name
Active raised bogs	Active raised bogs
Alkaline fens	Calcium-rich springwater-fed fens
<i>Anas acuta</i>	Pintail
<i>Anas crecca</i>	Teal
<i>Anas strepera</i>	Gadwall
<i>Anser albifrons albifrons</i>	Russian white-fronted goose
Assemblage of in-shore non-breeding waterfowl, including <i>Gavia stellata</i> and <i>Melanitta nigra</i>	
Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritimae</i> )	Atlantic salt meadows
Blanket bogs	Blanket bog
Bog woodland	Bog woodland
Calaminarian grasslands of the <i>Violetalia calaminariae</i>	Grasslands on soils rich in heavy metals
Calcareous and calcshist screes of the montane to alpine levels ( <i>Thlaspietea rotundifolii</i> )	Base-rich scree
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	Calcium-rich fen dominated by great fen sedge (saw sedge)
<i>Calidris alpina</i>	Dunlin
<i>Calidris canutus</i>	Knot
Coastal lagoons	Lagoons
<i>Cygnus columbianus bewickii</i>	Bewick's swan
Degraded raised bogs still capable of natural regeneration	Degraded raised bogs
Depressions on peat substrates of the <i>Rhynchosporion</i>	Depressions on peat substrates
Embryonic shifting dunes	Shifting dunes
<i>Falco columbarius</i>	Merlin
Fixed dunes with herbaceous vegetation ("grey dunes")	Dune grassland
<i>Gavia stellata</i>	Red-throated diver
<i>Haematopus ostralegus</i>	Oystercatcher
<i>Halichoerus grypus</i>	Grey seal
Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	Calcium-rich nutrient-poor lakes, lochs and pools
<i>Limosa</i>	Black-tailed godwit
<i>Liparis loeselii</i>	Fen orchid
<i>Margaritifera</i>	Freshwater pearl mussel
<i>Melanitta nigra</i>	Common scoter
Molinia meadows on calcareous, peaty or clayey-silt-laden soils ( <i>Molinion caeruleae</i> )	Purple moor-grass meadows
Mudflats and sandflats not covered by seawater at low tide	Intertidal mudflats and sandflats
Natural dystrophic lakes and ponds	Acid peat-stained lakes and ponds

Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> -type vegetation	Naturally nutrient-rich lakes or lochs which are often dominated by pondweed
<i>Numenius arquata</i>	Curlew
Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles	Western acidic oak woodland
Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i>	Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels
<i>Petalophyllum ralfsii</i>	Petalwort
Petrifying springs with tufa formation ( <i>Cratoneurion</i> )	Hard-water springs depositing lime
<i>Pluvialis squatarola</i>	Grey plover
<i>Pyrrhocorax</i>	Chough
<i>Sterna albifrons</i>	Little tern
<i>Sterna hirundo</i>	Common tern
<i>Tadorna tadorna</i>	Shelduck
<i>Tilio-Acerion</i> forests of slopes, screes and ravines	Mixed woodland on base-rich soils associated with rocky slopes
<i>Tringa totanus</i>	Redshank
<i>Turloughs</i>	Turloughs
<i>Tursiops truncatus</i>	Bottlenose dolphin
<i>Vertigo angustior</i>	Narrow-mouthed whorl snail
<i>Vertigo moulinsiana</i>	Desmoulin's whorl snail

**Appendix B: Qualitative assessment of the relative sensitivity to climate-induced change of issue and risk sub-categories (based on Wilson et al. 2013)**

Issue or risk sub-category (as derived from NRW Actions Database)	Issue or risk relative sensitivity
Climate change	High
Coastal flood defence and erosion control (squeeze)	High
Diseases pathogens and parasites	High
Drainage	High
Energy production - renewables: hydro-electric	High
Fire - deliberate or accidental	High
Inland flood defence and erosion control	High
Natural coastal processes and sediment supply	High
Tree planting, past and present	High
Water abstraction	High
Water levels (inc. barriers to natural hydrology and altered water flow)	High
Water quality - sediment pollution	High
Water quality - turbidity	High
Acidification	Medium
Air pollution	Medium
Freshwater invasive species - native	Medium
Freshwater invasive species - non-native	Medium
Marine invasive species - non-native	Medium
Off-site issues (e.g. migratory species)	Medium
Terrestrial invasive species - native and archaeophyte	Medium
Terrestrial invasive species - non-native	Medium
Water pollution - diffuse sources	Medium
Water pollution - discharge(s)/point source (inc. thermal, radioactive and oil)	Medium
Woodland management and tree felling	Medium
Freshwater fish stocking	Low
Access for sea fisheries	Low
Access/use - erosion/disturbance/damage	Low
Aggregate extraction	Low
Angling – freshwater	Low
Angling - sea	Low
Boats - not powered	Low
Boats - powered	Low
Cutting/ mowing - excessive	Low
Cutting/ mowing - insufficient	Low
Deer grazing/ browsing	Low
Ditch management	Low
Dredging - maintenance	Low
Educational /scientific use	Low
Energy production - renewables - solar	Low

Fertilizer use	Low
Freshwater fisheries management	Low
Game management	Low
Grazing insufficient grazing	Low
Grazing overgrazing	Low
Grazing type and/or timing (inc. shepherding)	Low
Habitat loss and fragmentation	Low
Hand gathering of fish / shellfish / seaweed	Low
Herbicide/ pesticide use	Low
Inappropriate coastal management e.g. beach cleaning	Low
Inappropriate vehicle use	Low
Infrastructure - construction	Low
Infrastructure - maintenance	Low
Insufficient tree management	Low
Light pollution	Low
Marine litter	Low
Military	Low
Modification to more intensive agricultural practise	Low
Modified water courses	Low
Molluscan farming and assoc. structures (ropes, trestles, poles)	Low
Mooring	Low
Mooring and anchoring (small boats e.g. in eel-grass beds)	Low
Netting - fixed (gill, tangle, trammel)	Low
Netting - drift (gill trammel)	Low
Netting - purse and beach seine	Low
Netting (fixed engine and fyke nets)	Low
Oil and gas exploration	Low
Pollution response	Low
Potting (crab, lobster, prawn, whelk)	Low
Predation and pest control	Low
Quarrying and mining	Low
Removal of species feature	Low
Scrub invasion	Low
Siltation	Low
Stock feeding	Low
Structural problems, renovation issues, buildings, bridges, caves	Low
Trawling - demersal towed other (inc. otter)	Low
Vessel accidents and associated issues	Low
Vessel maintenance & repair (incl. antifouling)	Low
Waste impacts - dumping spoil, leachate, sludge, etc.	Low
Waste impacts - fly-tipping, litter, etc.	Low
Weed control	Low
Weirs and other in-channel structures	Low
Wildfowling	Low

## Appendix C: Natura 2000 sites recorded as having habitat fragmentation as an issue or risk adversely affecting (or having the potential to adversely affect) features of that site

Data was derived from the NRW Actions Database following work by the LIFE Natura 2000 Programme. High, medium and low priority issues/risks are included. Instances may be recorded for the whole site or at a more detailed 'management unit' (sub-site) level.

Data from September 2015.

Site name	SAC/ SPA	Number of instances site affected		
		Unit level	Site level	Total
Deeside and Buckley Newt Sites	SAC	40	1	41
Corsydd Mon / Anglesey Fens	SAC	19	-	19
Corsydd Llyn / Llyn Fens	SAC	17	-	17
Fenn's, Whixall, Bettisfield, Wem and Cadney Mosses	SAC	10	-	10
Johnstown Newt Sites	SAC	9	1	10
Eryri / Snowdonia	SAC	6	1	7
Blaen Cynon	SAC	3	1	4
Carmarthen Bay Dunes / Twyni Bay Caerfyrddin	SAC	2	1	3
Glaswelltiroedd Cefn Cribwr / Cefn Cribwr Grasslands	SAC	3	-	3
Glan-traeth	SAC	2	-	2
Rhos Llawr-cwrt	SAC	1	1	2
Aberbargoed Grasslands	SAC	-	1	1
Alyn Valley Woods / Coedwigoedd Dyffryn Alun	SAC	-	1	1
Cadair Idris	SAC	-	1	1
Caeau Mynydd Mawr	SAC	-	1	1
Clogwyni Pen Llyn / Seacliffs of Llyn	SAC	-	1	1
Coedydd Aber	SAC	-	1	1
Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat	SAC	-	1	1
Cors Caron	SAC	1	-	1
Cors Fochno	SAC	1	-	1
Corsydd Eifionydd	SAC	-	1	1
Dyfi Estuary / Aber Dyfi	SPA	-	1	1
Gower Commons / Tiroedd Comin Gwyr	SAC	-	1	1
Granllyn	SAC	-	1	1
Kenfig / Cynffig	SAC	-	1	1
Llwyn	SAC	-	1	1
Morfa Harlech a Morfa Dyffryn	SAC	-	1	1
Mynydd Epynt	SAC	-	1	1
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro	SAC	-	1	1

Rhos Talglas	SAC	-	1	1
River Wye / Afon Gwy	SAC	-	1	1
Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat Ac Efyrynwy	SAC	-	1	1
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy	SAC	-	1	1
Wye Valley Woodlands / Coetiroedd Dyffryn Gwy	SAC	-	1	1
Y Twyni o Abermenai i Aberffraw / Abermenai to Aberffraw Dunes	SAC	-	1	1
Yerbeston Tops	SAC	-	1	1
<b>Total</b>		<b>114</b>	<b>29</b>	<b>143</b>

## Appendix D: Natura 2000 features recorded as being adversely affected (or having the potential to be adversely affect) by habitat fragmentation on sites

Data was derived from the NRW Actions Database following work by the LIFE Natura 2000 Programme. High, medium and low priority issues/risks are included. Instances may be recorded for the whole site or at a more detailed 'management unit' (sub-site) level.

Data from September 2015.

Feature (common name)	Number of instances feature affected		
	Unit level	Site level	Total
Great crested newt	51	3	54
Calcium-rich springwater-fed fens	33	-	33
Marsh fritillary butterfly	22	8	30
Calcium-rich fen dominated by great fen sedge (saw sedge)	21	-	21
Degraded raised bogs	11	-	11
Western acidic oak woodland	3	3	6
Geyer`s whorl snail	5	-	5
Purple moor-grass meadows	4	1	5
Fen orchid	2	3	5
Lesser horseshoe bat	-	5	5
Southern damselfly	4	-	4
Dry heaths	3	1	4
Dunes with creeping willow	-	4	4
Humid dune slacks	-	4	4
Otter	1	2	3
Shifting dunes	-	3	3
Dune grassland	-	3	3
Shifting dunes with marram	-	3	3
Mixed woodland on base-rich soils associated with rocky slopes	-	3	3
Alpine and subalpine heaths	2	-	2
Blanket Bog	2	-	2
Desmoulin`s whorl snail	2	-	2
Wet heathland with cross-leaved heath	2	-	2
Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels	-	2	2
Greater horseshoe bat	-	2	2
Acidic scree	1	-	1
Alpine and subalpine calcareous grasslands	1	-	1
Montane acid grasslands	1	-	1
Plants in crevices in base-rich rocks	1	-	1
Species-rich grassland with mat-grass in upland areas	1	-	1
Tall herb communities	1	-	1



Allis shad	-	1	1
Twaite shad	-	1	1
Greenland white-fronted goose	-	1	1
Beech forests on neutral to rich soils	-	1	1
Atlantic salt meadows	-	1	1
White-clawed -or Atlantic stream- crayfish	-	1	1
Bullhead	-	1	1
River lamprey	-	1	1
Brook lamprey	-	1	1
Sea lamprey	-	1	1
Atlantic salmon	-	1	1
Dry grasslands and scrublands or chalk or limestone	-	1	1
Yew-dominated woodland	-	1	1
Very wet mires often identified by an unstable 'quaking' surface	-	1	1
Vegetated sea cliffs	-	1	1
Narrow-mouthed whorl snail	-	1	1
Rivers with floating vegetation often dominated by water-crowfoot	-	1	1